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**SUPERSEDED BY EB 98-014 EFFECTIVE 4/24/98**

# ENGINEERING INSTRUCTION

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SUBJECT: STANDARD SPECIFICATIONS: SECTION 554 - MECHANICALLY STABILIZED EARTH SYSTEM
Subject Code: 7.27-1-554

Distribution: 31 [X] Main Office 33 [X] Regions 34 [X] Special

APPROVED: E.V. Hourigan
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Code: E.I. 86-11
Date: Feb. 27, 1986
Supersedes:

This Engineering Instruction transmits new SECTION 554-MECHANICALLY STABILIZED EARTH SYSTEM. This Section replaces the following special items:

| | | |
|---|---|---|
| 16203.0106 | 16203.290501 | 16203.290502 |
| 16203.0206 | 16203.290601 | 16203.290602 |
| 16203.0306 | 16203.290701 | 16203.290702 |

Major differences between SECTION 554 and the items listed above are:

A. Pay item 554.01 is to be used for any approved system. Separate pay items for different systems are no longer necessary.

B. Excavation for earth systems will be paid for in accordance with the proper excavation item. e.g. 203.01, 203.02, or other appropriate item.

C. Facing units and earth system backfill are included together under item 554.01.

The earth systems presently available to the Department are patented designs, and the patent licensees require that certain materials critical to the installation be purchased exclusively through their companies. Accordingly, only approved designer-suppliers are permitted to bid on New York State projects. Approval of the various companies is the responsibility of this office since we are required to approve their original design submissions, and we control the inspection of the precast concrete face panel units.

Presently there are only two approved designer-suppliers. They are noted on the approved list attached to this E.I. Since there are only two, it will not be necessary for the designer to justify the use of item 554.01 on proprietary grounds. This office will keep and update the approved list.

The decision to designate a mechanically stabilized earth system for a particular project requires the approval of this office. Approval, in turn, is dependent upon:

1. The facing panels must be a minimum of 15'-17' above the leveling footing at their highest elevation not including coping depth. The overall average height must be between 10'-12'.

2. The exposed face area, not including coping, must be in excess of 1500 square feet.

3. The system must be substantially a fill system. Locations which require extensive excavation will not be approved.

4. No utility, of any nature, may be within, or underneath, the system.

5. Railroad involvement requires Railroad approval. Railroad approval must accompany the design approval request forwarded to this office.

6. Detailed cost comparisons, for each proposed location, between the earth system and a conventional concrete wall design, are required. Approval requests lacking such comparisons will not be reviewed.

Questions regarding earth system designs should be addressed to:
R.G. Warren 518-453-6105

Questions regarding approval requests should be directed to:
R.L. Parker 518-453-6122, or T.D. Quinn 518-457-6407

Questions regarding the text of SECTION 554, or pay item 554.01 should be directed to:
R.L. Ecuyer 518-453-6113

This Engineering Instruction takes effect with the Letting of June 26, 1986 (P.S. & E. April 3, 1986).

## SECTION 554 - MECHANICALLY STABILIZED EARTH SYSTEM

554-1 DESCRIPTION. The work shall consist of constructing a mechanically stabilized earth system at the locations indicated on the plans.

A mechanically stabilized earth system is comprised of an unreinforced concrete footing, facing units, earth backfill, and a material used to stabilize the backfill. For the purposes of this section all stabilizing material will be referred to as reinforcing, regardless of its material composition, or configuration.

The Contractor is hereby notified that mechanically stabilized earth systems may be patented, and all necessary materials except backfill and cast-in-place concrete shall be obtained from the approved system designer. Approved designers appear on the Department's approved list. Immediately upon award of contract the Contractor shall notify the D.C.E.S. of the name and address of the chosen designer-supplier. Once designated, the designer-supplier shall not be changed.

All mechanically stabilized earth systems shall be designed and the design stamped by a Professional Engineer licensed to practice in New York State.

The Contractor shall require the designated designer-supplier to supply a qualified experienced technical representative to advise the Contractor and the Engineer concerning proper installation procedures.

Two weeks prior to the beginning of any construction, the Contractor shall supply the Engineer with two copies of the designer-supplier's Installation Manual. In addition, the Engineer shall verify that the Contractor is also in possession of two copies of the Installation Manual.

554-1.01 DEFINITIONS. The following definitions shall apply:

A. Facing Unit. A precast concrete panel, incorporating means for attaching the reinforcing, forming part of the face area of the mechanically stabilized earth system. A corner unit is a facing unit having two faces.

B. Reinforcing. A metal strip, or wire mesh, or other similar material connected to the facing unit for the purpose of fill stabilization.

C. Attaching Devices. Anything cast into the facing unit to provide a means for attaching reinforcing.

D. Fastener. Anything used to connect the reinforcing to the attaching device.

E. Joint Filler. Material used to fill the joints between units.

554-2 MATERIALS. The Contractor is cautioned that all of the materials listed are not required for each mechanically stabilized earth system. It shall be the Contractor's responsibility to ensure that the proper materials are supplied for the chosen system design. Materials shall meet the following requirements:

554-2.01 FACING UNITS. These shall be fabricated in accordance with the requirements of 718-24. The Contractor shall notify the D.C.E.S. of the name and address of the units fabricator no later than fourteen days after award of contract.

Precast concrete coping and other incidental precast units shall be fabricated in accordance with the requirements of 718-24.

554-2.02 REINFORCING STRIPS. These shall meet the requirements of:

A. ASTM Designation A446, Grade C, Coating Class G210, chemically treated only

OR

B. ASTM Designation A36. Reinforcing strips supplied under this requirement shall be galvanized in accordance with the requirements of 719-01, Type I.

OR

C. ASTM Designation A572, Grade 65. Reinforcing strips supplied under this requirement shall be galvanized in accordance with the requirements of 719-01, Type I.

554-2.03 REINFORCING MESH. The reinforcing mesh shall be shop fabricated from cold drawn steel wire conforming to the requirements of ASTM A82 and shall be welded into the finished mesh fabric in accordance with ASTM A185. Galvanization shall be in accordance with 719-01, Type I.

554-2.04 FASTENERS. Nuts and bolts shall meet the requirements of ASTM A325, Type II. They shall be galvanized in accordance with 719-01, Type II.

554-2.05 ATTACHING DEVICES.

A. Coil Bolts. Each coil bolt shall have two inches of thread. It shall be cast of 80-55-06 ductile iron conforming to ASTM A536. Galvanizing shall conform to 719.01, Type II. It shall be capable of developing the full ultimate strength of attached reinforcing.

554-2.06 JOINT FILLERS. Joints shall be filled with material approved by the D.C.E.S. and supplied by the approved earth wall system designer.

554-2.07 CAST-IN-PLACE CONCRETE. All cast-in-place concrete shall meet the requirements of Section 501, Class A concrete.

554-2.08 BACKFILL. Only suitable material shall be acceptable for backfill. In general, any mineral (inorganic) soil, blasted or broken rock, or similar materials of natural origin, including mixtures, are suitable materials. The Engineer shall determine whether a specific natural material is suitable as backfill with prior approval of the D.C.E.T.S.

A. The backfill material, excluding blasted, or broken, rock shall have no particles greater than six inches in maximum dimension. The portion passing the four inch square sieve shall be graded in accordance with Table 554-1.

TABLE 554-1

STRIP REINFORCING

| Sieve Size | % Passing by Weight |
|---|---|
| 1/4 inch square | 30-100 |
| No. 40 Mesh | 0-70 |
| No. 200 Mesh | 0-15 |

MESH REINFORCING

| Sieve Size | % Passing by Weight |
|---|---|
| 1/4 inch square | 25-75 |
| No. 10 Mesh | 0-50 |
| No. 40 Mesh | 0-25 |
| No. 200 Mesh | 0-10 |

B. Rock material used for backfill shall be broken, or blasted, unweathered rock. The rock material shall have no particles greater than eight inches in maximum dimension, and little or no material passing the No. 10 mesh sieve.

C. Material to be placed within one foot of all drainage structures, or utility lines, shall have no particle dimension greater than three inches.

D. If the State tests for durability, material having a Magnesium Sulphate Soundness loss in excess of 30 percent will be rejected and will not be placed in the work.

E. If the State tests for corrosive potential, material failing to meet all of the requirements of TABLE 554-2 will be rejected and will not be incorporated in the work.

TABLE 554-2

| | | |
|---|---|---|
| Resistivity... | ≥ | 3000 ohm-cm.* |
| pH... | | 5 to 10 |
| Sulphates... | ≤ | 500 mg/kg. |
| Sulphides... | ≤ | 300 mg/kg. |
| Chlorides... | ≤ | 100 mg/kg. |

*Resistivity testing will be done in accordance with current Departmental procedures.

554-2.09 IDENTIFICATION MARKERS.

A. Signs. These will be 7" x 10" fiberglass.

B. Marking Tape. This will be polyethylene material 3" wide, 4 mils thick.

Signs and marking tape will be provided by the chosen designer-supplier.

554-2.10 BASIS OF ACCEPTANCES.

A. Facing Units. Acceptance shall be in accordance with the requirements of 718-24.

B. Cast-In-Place Concrete. The requirements of 501, Class A concrete, shall apply.

C. Other materials. These will be accepted by certification. The State, however, reserves the right to sample, test and reject certified material in accordance with Departmental written instructions.

554-3 CONSTRUCTION DETAILS.

554-3.01 The excavation and disposal of all excavated material shall meet the requirements of Section 203, except as modified herein.

A. The area upon which the mechanically stabilized earth system will rest shall be graded level for a width equal to, or in excess of, the reinforcing length. Prior to wall system construction, this area shall be compacted in a manner satisfactory to the Engineer. All soils found to be unsuitable, or incapable of sustaining the required compaction, shall be treated in the manner directed by the Engineer, in conjunction with the recommendations of the Regional Soils Engineer.

B. Rock shall be removed to the limits indicated on the plans.

554-3 CONSTRUCTION DETAILS. (cont'd)

C. The depth of excavation for the leveling footing will be indicated on the plans. The cost of this excavation will be included in a separate excavation item.

554-3.02 FACING UNIT INSPECTION, STORAGE, REPAIR AND REJECTION.

A. Precast concrete facing units shall be inspected upon arrival at the work site to determine conformance to dimensional tolerances, as well as damage during shipment. An additional inspection will be made prior to erection to determine any damage which may have occurred during storage. The Contractor shall handle and store the units with extreme care to prevent damage.

B. Units which do not meet dimensional tolerances, as determined by the Engineer, will be rejected. They shall be replaced by the Contractor with units acceptable to the Engineer.

C. Damaged units shall be repaired in a manner approved by the Engineer. Units which the Engineer determines cannot be repaired will be rejected and shall be replaced by the Contractor with units acceptable to the Engineer.

D. Responsibility for the rejection of units shall rest solely with the Engineer, providing the total number of rejected units does not exceed five percent of the total number of required units. Should the total number of rejections exceed five percent of the required total, the rejected units in excess of five percent shall be rejected only with the concurrence of the D.C.E.S.

554-3.03 STRUCTURE ERECTION.

A. Methods and Equipment. Units shall be erected in accordance with the designer-supplier's Installation Manual, unless otherwise modified by the Contract Documents, or the Engineer. Prior to erection of the units, the Contractor shall furnish the Engineer with detailed information concerning the proposed construction method, as well as the specific construction equipment planned for use. No work shall be done prior to the Engineer's approval of the Contractor's proposed methods.

B. An unreinforced concrete leveling footing shall be provided as required by the plans. The concrete shall be placed in accordance with the requirements of 555-3. The Engineer may waive any part of 555-3, that he determines is impractical.

554-3.03 STRUCTURE ERECTION. (cont'd)

C. Unit Erection.

1. Units shall be placed such that, ater completion of compaction, the requirements of TABLE 554-3 are not exceeded. After placement, each unit shall be maintained in position by a method acceptable to the Engineer. If wedges are used, they shall not be allowed to remain in place below three panel unit heights during installation, and compaction. Further, all wedges remaining in the top three panel unit heights shall be removed upon completion of the mechanically stabilized earth system. External braces may be required for initial placements. Joint fillers shall be installed in the manner indicated by the plans.

2. All misalignments of installed units in excess of the tolerances allowed by Table 554-3 shall be corrected by the Contractor, in a manner satisfactory to the Engineer at no additional cost:

TABLE 554-3

Horizontal alignment... ± 3/4 in. per 10 ft.
Joint offset per unit... ± 1/2 in.
Overall vertical plumbness
(Top to bottom of wall system)... ± 1/2 in. per 10 ft. of height.

2. The Contractor shall govern his operations and procedures to prevent misalignment of the installed panel units. Precautionary measures shall include, but not be limited to, keeping vehicular equipment a minimum of three feet from the panel units. Compaction equipment used within three feet of the panel units shall meet the requirements of 203-3.12B6.

D. Backfill.

1. Backfill materials, other than rock, shall be placed at a moisture content less than, or equal to, the Optimum Moisture Content. Backfill material placed at a moisture content in excess of the Optimum Moisture Content shall be removed. Such material shall be either reworked, or replaced, as determined by the Engineer. The Optimum Moisture Content shall be determined in accordance with the Soil Test Methods for compaction which incorporate moisture content determination. Test methods used will be those in effect on the date of advertising.

D. Backfill. (cont'd)

2. Granular backfill material shall be placed in uniform layers not exceeding twelve inches loose lift thickness per layer. Each layer shall be compacted to a minimum of 95 percent of Standard Proctor Maximum Density. The type of compactor, travel speed and number of passes shall be in accordance with 203-3.12.

3. Rock backfill shall be placed in uniform layers not exceeding fifteen inches loose lift thickness. Compaction requirements will be determined by the Engineer.

E. Reinforcing.

1. Prior to placement of the reinforcing, backfill within three feet of the panel units horizontally shall be within one inch, or less, below the required reinforcing elevation. Backfill beyond the three foot line may be roughly graded to the reinforcing elevation.

2. Damage to the zinc coating shall be repaired in accordance with the requirements of 719-01 before attaching the reinforcing to the panel units.

3. All openings, or attachment locations, required to be filled with grease, or other protective material, shall be filled prior to the attachment of the reinforcing. The grease, or other protective material shall be that supplied by the chosen designer-supplier.

4. Reinforcing shall be placed normal to the panel units unless indicated otherwise by the plans. Care shall be taken to avoid breaking, distorting, or disturbing the reinforcing. Reinforcing which is broken, or distorted, as determined by the Engineer, shall be replaced by the Contractor.

554-4 METHOD OF MEASUREMENT. The quantity will be determined as the total number of square feet of face area. Quantity determination shall be computed from the plans using the following limits:

Vertical.

1. Topmost surface of the leveling footing.

2. Topmost surface of the facing units.

Horizontal.

Limits indicated on the plans.

554-4 METHOD OF MEASUREMENT. (cont'd)

The computations shall take into consideration the possible variation in the elevations of the footing and the top of facing units. No field measurements will be made unless the Engineer specifies in writing a change to the limits indicated on the plans.

554-5 BASIS OF PAYMENT

A. Mechanically Stabilized Earth System. The unit price bid per square foot of face area shall include the cost of all labor, equipment, and materials, including backfill, leveling footing, joint fillers, and coping, unless otherwise modified by the Contract Documents.

B. Excavation and disposal of excavated material will be paid for under a separate item.

C. No payment will be made for damaged units, nor for units which do not meet dimensional tolerances. Such units shall be repaired, or replaced, as determined by the Engineer, at no additional cost to the State.

D. No payment will be made for reinforcing which the Engineer orders replaced. Such reinforcing shall be replaced at no additional cost.

E. The cost of adding water for backfill compaction shall be included in the unit price bid for the mechanically stabilized earth system, unless items for Furnishing Water Equipment and Applying Water are included in the Contract. If these items are included, the cost of adding water shall be included in their bid prices.

Payment will be made under:

| Pay Item Number | Item | Unit |
|---|---|---|
| 554.01 | Mechanically Stabilized Earth System | S.F. |

## 718-24 - PRECAST CONCRETE PANEL UNITS (Mechanically Stabilized Earth System)

SCOPE:

This specification covers the material and fabrication requirements for the precast concrete panel units indicated on the Contract Drawings. These units shall be used to construct a mechanically stabilized earth system.

The word "unit(s)", wherever it appears, shall be understood to mean precast concrete panel units, whether face panel units or corner panel units.

All units shall be obtained through the designated, approved designer-supplier.

MATERIALS:

General. The materials used for the fabrication of these units shall be either Manufacturer certified or Department approved prior to being incorporated in the units. Unless specifically noted as accepted by certification, the materials shall be Department approved through Department quality assurance procedures.

The Contractor is hereby notified that some of the listed materials are peculiar to specific precast panel designs. It is the Contractor's responsibility to ensure that the proper materials are included in the chosen precast panel design.

Concrete. Concrete shall meet the requirements of 501, 501-2 and 501-3, with modifications as noted:

1. Cement shall be Type 1, Type 2, or Type 3. Only one type and brand of cement shall be used for the units required for any one structure. NOTE: The use of Type 3 cement shall be restricted to concrete cured in accordance with Method 1 or 2, under Curing of this specification.

2. Coarse aggregate gradation shall be N.Y.S., No. 1 size or ASTM Designation D448, No. 67 size.

3. Concrete proportioning requirements for the respective classes of concrete shall not apply.

4. Air content shall be 5.5% minimum, 7.0% desired, and 9.0% maximum.

5. Automatic proportioning equipment will not be required but is allowed.

Reinforcing Bars. Reinforcing bars shall meet the requirements of 709-04; Epoxy Coated Bar Reinforcement, Grade 60.

## 718-24 PRECAST CONCRETE PANEL UNITS (Mechanically Stabilized Earth System)

Tie Strips. Steel tie strips shall meet the requirements of any one of the following:

a. ASTM Designation A570, Grade C, and galvanized in accordance with the requirements of 719-01, Type I; OR

b. ASTM Designation A570, Grade 36, and galvanized in accordance with the requirements of 719-01, Type I; OR

c. ASTM Designation A570, Grade 50 and galvanized in accordance with the requirements of 719-01, Type I.

Acceptance of this material shall be based on manufacturer's certification.

Coil Embed. The coil embed shall be fabricated from cold drawn steel wire conforming to AISI C1035, and galvanized in accordance with the requirements of ASTM B695.

Acceptance of this material shall be based upon manufacturer's certification.

Grease. Grease used in coil embed holes shall be that approved by the D.C.E.S. and supplied by the designated designer-supplier.

Dowels. Dowels shall meet the requirements of the designated designer-supplier.

Acceptance of this material shall be based on manufacturer's certification.

Dowel Sleeves. Dowel sleeves (PVC pipe) shall meet the requirements of the designated designer-supplier.

Lifting Devices. The type and adequacy of lifting devices shall be in accordance with the directives of the designated designer-supplier.

FABRICATION:

Inspection. Fabrication of the units shall be inspected by an Inspector designated by the State. The Contractor shall inform the State seventy-two hours prior to:

1. Commencement of work.

2. Commencement of work after a work suspension of forty-eight (48) hours or more.

3. Unit shipping.

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The Contractor shall keep the Inspector accurately informed of day-to-day fabrication scheduling operations. The inspector shall have free access to the fabrication plant in order to satisfy himself that the work being done is in conformance with the Contract Documents. The Inspector shall be present during all testing. Work done at any time the Inspector has been refused or prevented from access shall automatically be rejected.

Production Note Sheet. The Contractor shall submit to the D.C.E.S. the in-process production information required below. Except as noted, this information shall require the approval of the D.C.E.S., prior to the beginning of any fabrication. All information shall be noted on a sheet titled: PRODUCTION NOTE SHEET.

1. Size and Type of Sheet: The size and type requirements of Subparagraph 2A-Working Drawings, Size and Type, as given in 718-01, under Drawings, shall apply.

2. Information Required: The following information shall be given:

   a. Description of the fabricating plant, including any backup concrete mixing facilities; original design mix* and proposed me hod of concrete placement. Modifications to, or deviations from, the original design mix, which occur at any time, shall be submitted in writing to the D.C.E.S.

      *including name and source of all constituents;

   b. Fabricating plant production schedule and size of Lot as required under CONCRETE STRENGTH VERIFICATION of this specification.

   c. Quality Control tests and procedures, including the number of cylinders to be sampled per lot.

   d. Method and outline of unit and cylinder curing procedure, as required under Curing of this specification.

   e. Winter concreting procedures, if need is anticipated.

   f. Typical piece mark, including the lot and casting sequence number and date.

   g. Precasting tolerances as required under TOLERANCES of this specification.

   h. Concrete lifting strength, and twenty-eight day strength.

3. Submission For Approval: The procedures described under SUBMISSION OF WORKING DRAWINGS, of 718-01, shall apply.

Approval of the production note sheet shall not constitute approval of the information required under 2.a., above. This data is for informational purposes only.

Commencement of Work. No fabrication work shall be started until the Production Note Sheet has been approved and the Department's Inspector has received official copies.

Data For Inspector Approval. No fabrication work shall be started until the Inspector has received and approved the following data:

1. A calibration certificate attesting to the fact that the concrete cylinder testing machine to be used has been calibrated within the twelve (12) month period immediately prior to the first date of actual use of the machine.

2. Certificates indicating compliance with the requirements of this specification for all material incorporated as part of the unit.

Concrete Forms. Forms shall be well constructed, carefully aligned, and sufficiently tight to prevent leakage of mortar. The forms shall be constructed in a manner to allow all exposed faces of the unit to be cast against a steel form except where an architectural finish is specified.

All form surfaces that come in contact with the concrete shall be thoroughly treated with a form coating in the manner and at the rate specified by the Manufacturer. Only form coatings which appear on the Department's approved list shall be used.

Reinforcement and Appurtenances. Prior to installation in the units, the reinforcement and any other embedded material shall be free of frost, dirt, oil, or any material that may prevent bond between it and the concrete.

Concrete Mix Design and Proportioning. The Contractor shall be responsible for designing a concrete mix to produce the required minimum compressive concrete strength in the units as determined by test cylinders sampled, cured, and tested in accordance with this specification. If no compressive strength is indicated on the Contract Drawings, the required minimum compressive strength shall be 4,500 psi at 28 days.

Maximum cement content for the design mix shall be limited to eight bags per cubic yard.

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The Contractor may request permission from the D.C.E.S. to incorporate a High Range Water Reducing (HRWR) admixture into the concrete mix. The D.C.E.S. will grant such permission only if he deems it to be in the best interests of the State and then only under such conditions as the D.C.E.S. requires.

Concrete Placement. No concrete shall be placed in the forms without the Inspector's approval.

Plastic concrete shall be consolidated in place by internal or external vibration methods or both. Internal vibrators shall be the "pencil" type. All vibrators shall be approved by the Inspector prior to use. Vibrators shall be used only to consolidate concrete after it has been properly placed. They shall not be used to move concrete within the forms. Internal vibrators shall be slowly inserted and removed from the concrete.

Suitable means shall be used for placing concrete to prevent segregation. Concrete shall not be dropped from a height greater than one (1') foot above the top of the forms. Special care shall be taken to deposit the concrete in its final position in each part of the form.

The following quality control tests shall be performed and recorded by the Contractor, in the presence of the Inspector, from the same concrete sample as that used to satisfy the CONCRETE STRENGTH VERIFICATION requirements of this specification:

1. Slump
2. Air Content
3. Temperature
4. Weight Per Cubic Foot

If truck-mixed concrete is employed, the Contractor shall sample concrete from each truck, immediately after depositing an initial quantity of concrete in the next panel, and perform these tests prior to discharging the remaining portion of the load.

Winter Concreting. If the atmospheric temperature is below 45°F., fabrication of the units shall only be done in accordance with the Winter Concreting procedures noted on the PRODUCTION NOTE SHEET. If Winter Concreting Procedures have not been previously approved, the Contractor shall submit them for approval in accordance with the Submission For Approval Subsection of this specification. The D.C.E.S. will make every effort to reply in a timely manner. However, the time taken to review the Winter Concreting procedures shall not be a reason to request an extension of time as provided for by 108-04. No additional compensation shall be made if Winter Concreting procedures are employed.

718-24 - PRECAST CONCRETE PANEL UNITS (Mechanically Stabilized Earth System)

Curing. The method of curing concrete units and cylinders shall be one of the following and shall meet the requirements noted below:

| | | |
|---|---|---|
| 1. | Low Pressure Steam; | 718-01. |
| 2. | Radiant Heat and Moisture: | 718-01. |
| 3. | Water Spray; | 706-02. |
| 4. | Saturated Cover; | 718-01. |

Cylinders shall be cured in the same manner as the lot of units they represent.

Record of Curing; Time-Temperature. The Contractor shall provide automatic temperature recorders to continuously record the curing time and temperature. The actual number of recorders required will depend upon the method of cure chosen, and the type of form set-up. The PRODUCTION NOTE SHEET shall indicate the number of recorders as part of the curing information submitted for approval.

After curing is completed, all charts shall be properly marked and given to the Inspector.

CONCRETE STRENGTH VERIFICATION.

1. General.

   a. Concrete strength shall be determined from concrete test cylinders made in conformance with the requirements of ASTM Designation C31. All cylinders shall be tested in conformance with ASTM Designation C39, on a testing machine approved by the Inspector. All cylinders shall be made and tested by the Contractor, in the presence of the inspector.

   b. Cylinders shall be made from the same batch of concrete actually placed in the units. The Inspector shall be the sole judge, as to which cylinders are defective or damaged, and are not to be included in the determination of the strength class.

   c. The Contractor shall cast a sufficient number of concrete test cylinders to fulfill the strength test requirements as stated in Testing For Concrete Strength. The Contractor may submit to the D.C.E.S., for approval, an alternate sampling procedure based on his concreting operation. If the alternate sampling procedure is approved, the Contractor shall indicate it on the PRODUCTION NOTE SHEET.

   d. To verify Lifting Strength, a minimum of two cylinders shall be cast per lot.

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e. To verify 28-day strength, a minimum of four cylinders shall be cast for each lot. The lot size shall not exceed the lesser of:

1. Thirty Units; OR

2. The number of unit forms available for set-up at the time of casting (split units excepted).

The Contractor shall indicate, on the PRODUCTION NOTE SHEET, the number of units that shall be defined as a casting lot.

f. All units within a lot shall be cast without interruption. If an interruption in casting is encountered for a period in excess of one hour, the units cast prior to the interruption shall be defined as a lot, and a new lot shall be established for those units subsequently cast.

2. Testing For Concrete Strength. The strength requirement for each lot shall be verified by the Contractor before that lot is accepted for strength. Strength determination shall be accomplished as follows:

a. Lifting Strength: Two cylinders representing each lot shall be tested in immediate succession prior to lifting any panel in that lot from its form. The average strength of the two cylinders shall be equal to or greater than the Lifting Strength specified (by the Contractor) on the PRODUCTION NOTE SHEET.

b. 28-Day Strength: Two cylinders representing each lot shall be tested in immediate succession at twenty-eight days of age to verify the required 28-day strength of the concrete. The average strength of the two cylinders shall be equal to or greater than the required 28-day strength. If these requirements are not met, the remaining cylinders representing the lot shall also be tested at 28 days of age. Subsequently, the average strength of all cylinders representing the 28-day strength of that lot shall be equal to or greater than the required 28-day strength.

Option: The Contractor may test two cylinders representing each lot, in immediate succession, prior to the twenty-eight day age limit. The average strength of the two cylinders shall be equal to, or greater than, the required 28-day strength. If these requirements are met, the cylinder test at 28 days of age shall be waived. If the Contractor chooses this option, additional cylinders shall be made so that a minimum of four cylinders are available for testing at 28 days.

718-24 PRECAST CONCRETE PANEL UNITS (Mechanically Stabilized Earth System)

FINISHING:

All surfaces of concrete shall be true and even, free from rough, open, or honeycombed areas, depressions, or projections.

All uncoated steel, projecting from the panel unit, shall be coated with epoxy material, supplied by the coating applicator, prior to unit placement in the storage area. Epoxy material shall be applied and cured inaccordance with the coating applicator's instructions.

REJECTION OF UNITS:

Rejection of units and lots will be governed by the following:

1. Strength Requirements: A lot represented by cylinders not meeting the required 28 day strength of concrete, as specified under CONCRETE STRENGTH VERIFICATION, shall be rejected.

2. Deleterious Materials. The materials used for the manufacture of concrete shall not contain, or cause concentration of, chemicals or other deleterious materials that are injurious to concrete as determined by the D.C.E.T.S. A total concentration of chloride ions in excess of 0.10% by weight of cement per cubic yard of concrete will be considered injurious. Sampling and testing of concrete and materials, in order to determine specification conformance, will be in accordance with Department instructions. A lot represented by concrete samples indicating injurious chemical concentrations, or the presence of deleterious materials, shall be rejected.

3. Honeycombing. Honeycombing of the concrete to such an extent that chipping away of the honeycombed concrete results in exposed steel.

   If chipping of the honeycombed portion causes a hole more than one-half the thickness of the unit to result, the unit will be rejected.

   All honeycombed areas shall be chipped until sound concrete is detected. Sound concrete is defined as that point at which chipping causes fracture of the aggregates.

   The Inspector shall determine whether spalled, honeycombed, or otherwise defective concrete shall be repaired or be cause for rejection. The decision to repair a unit or reject it shall require the concurrence of the D.C.E.S. Repair of units, if allowed, shall be done in a manner satisfactory to the Inspector. Regardless of what manner of repair is used, repair to concrete surfaces which will be exposed to view after construction is completed, shall be such that the repaired area is not distinguishable from the non-repaired.

718-24 PRECAST CONCRETE PANEL UNITS (Mechanically Stabilized Earth System)

4. Tolerances. Just prior to shipping, all units shall be checked for compliance with the tolerances listed below. All units not meeting the listed tolerances shall be rejected. Responsibility for rejection shall rest solely with the Inspector, except that the total number of rejected units of day's production may not exceed twenty percent, without the concurrence of the D.C.E.S.

   Tolerances are as follows:

   a. Panel dimensions (edge-to-edge of concrete) shall be ± 3/16".

   b. Panel thickness shall be ± 1/4".

   c. Squareness. The length difference between two diagonals of approximately equal length shall not exceed 1/2".

   d. Distance between the centerline of dowel and dowel sleeve shall be ± 1/4".

   e. Face of panel to centerline of dowel and dowel sleeve, and to centerline of reinforcing steel shall be ± 1/8".

   f. Location of Tie Strip shall be ± 1".

   g. Location of Coil Embed shall be ± 1/8".

   h. Warping of the exposed panel face shall not exceed 1/4" in five feet.

SHIPPING:

No unit shall be shipped until the required twenty-eight day strength has been attained.

Each unit shall be clearly marked with its piece mark and the date of fabrication. This mark shall be indelible and shall be placed on a surface which will not be exposed to view after construction is complete.

No unit shall be shipped without the Inspector's stamp of approval.

BASIS OF ACCEPTANCE:

The Inspector's stamp of approval shall constitute basis of acceptance for shipment to the project site.

Approved List - Mechanically Stabilized Earth System Designers

Reinforced Earth Company
Rosslyn Center
1700 No. Moore Street
Arlington, VA 22209

VSL Corporation
P.O. Box 866
8006 Haute Court
Springfield, VA 22150